TABLE C-3-1

CONCENTRATION OF DIOXINS IN BREAST MILK

Description

This equation calculates the concentration of dioxins in milkfat of breast milk. Uncertainties associated with this equation include the following:

(1) The most significant uncertainties associated with this equation are those associated with the variable *m*. Because *m* is calculated as the sum of numerous potential intakes, estimates of *m* incorporate uncertainties associated with each exposure pathway. Therefore, *m* may be under- or overestimated. Every effort should be made to limit and characterize the uncertainties associated with this variable.

(2) This equation assumes that the concentration of dioxin in breast milkfat is the same as in maternal fat. To the extent that this is not the case, uncertainty is introduced.

Equation

$$C_{milkfat} = \frac{m \cdot 1\times10^{9} \cdot h \cdot f_1}{0.693 \cdot f_2}$$

Variable	Description	Units	Value
$C_{milkfat}$	Concentration of dioxin in milk fat of breast milk for a specific exposure scenario	pg COPC/kg milk fat	
m	Average maternal intake of dioxin for each adult exposure scenario	mg COPC/kg BW-day	**Varies** This variable is COPC- and site-specific and is equal to the total daily intake of dioxin (*I*), which is calculated using the equation in Table C-1-6 for each adult exposure scenario. The following uncertainty is associated with this variable: (1) The uncertainty associated with this variable may be significant, because this uncertainty represents the sum of all uncertainties associated with each of the potential exposure pathways. To gauge the potential magnitude of the uncertainty associated with this variable, estimated *m* values should be compared to values reported in the literature.
1×10^9	Units conversion factor	pg/mg	

TABLE C-3-1

CONCENTRATION OF DIOXINS IN BREAST MILK

Variable	Description	Units	Value
h	Half-life of dioxin in adults	days	**2,555** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). The following uncertainty is associated with this variable: As discussed in U.S. EPA (1994a), the half-life may vary from about 5 to 7 years for 2,3,7,8-TCDD. Use of the upper end of the range is conservative. Based on the work of Schecter (1991), and Schlatter (1991), as discussed in U.S. EPA (1994a), the value of *h* may vary by almost one order of magnitude (1.1 to 50) for different dioxin and furan congeners around the value of 7 proposed for 2,3,7,8-TCDD. The differences are largely the result of differences in absorption. However, if the average material intake of dioxin is calculated in terms of *TEQ*s, the use of a single *h* value based on 2,3,7,8-TCDD is assumed to be reasonable.
f_1	Fraction of ingested dioxin that is stored in fat	unitless	**0.9** This variable is COPC- and site-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994b). The source of this value is U.S. EPA (1994a).
f_2	Fraction of mother's weight that is fat	unitless	**0.3** This variable is COPC-specific. U.S. EPA OSW recommends the use of this default value, consistent with U.S. EPA (1994a) and U.S. EPA (1994b). The source of this value is U.S. EPA (1994a). The following uncertainty is associated with this variable: Although this single value clearly does not adequately represent all potentially exposed women of childbearing age, the average uncertainty associated with this value is assumed to be minimal.

TABLE C-3-1

CONCENTRATION OF DIOXINS IN BREAST MILK

(Page 3 of 3)

REFERENCES AND DISCUSSION

Schecter, A. 1991. "Dioxins and Related Chemicals in Humans and in the Environment." In: *Biological Basis for Risk Assessment of Dioxins and Related Compounds*: Gallo, M.; Schenplein, R; Van Der Heijden, K. Eds; Banbury Report 35, Cold Spring Harbor Laboratory Press.

This document is cited by U.S. EPA (1994a) as the source of information related to the metabolism of dioxin and related compounds, in addition to concentrations of various congeners in adipose tissue.

Schlatter, C., 1991. "Data on Kinetics of PCDDs and PCDFs as a Prerequisite for Human Risk Assessment." In: *Biological Basis for Risk Assessment of Dioxins and Related Compounds*; Gallo, M; Schenplein, R; Van Der Heijder, K., eds. Banbury Report 35, Cold Spring Harbor Laboratory press.

This document is cited by U.S. EPA (1994a) as a source of a method of estimating the half-life of dioxin-related compounds, based on uptake data relative to 2,3,7,8-TCDD. U.S. EPA (1994a) proposed the following equation, based on this document:

$$C_{TCDD} = \frac{D_{TCDD} \cdot t_{1/2},\ TCDD \cdot V}{\ln 2}$$

where

C_{TCDD}	=	Concentration of TCDD in body
D_{TCDD}	=	Daily intake of TCDD
$t_{1/2}$, *TCDD*	=	Half-life of TCDD in body
V	=	Volume of body compartment

Smith, A.H. 1987. "Infant Exposure Assessment for Breast Milk Dioxins and Furans Derived from Waste Incineration Emissions." *Risk Analysis.* 7(3) 347-353.

This document is cited by U.S. EPA (1994a) as the source of the equation in Table C-3-1 and the recommended values for h (2,555 days), f_1 (0.9), and f_2 (0.3). This document assumes that the concentration of dioxins in breast milkfat is the same as in maternal fat.

U.S. EPA. 1994a. *Estimating Exposure to Dioxin-Like Compounds. Volume II: Properties, Sources, Occurrence, and Background Exposures. Review Draft.* Office of Research and Development. EPA/600/6-88/0055Cb. Washington, D.C. June.

This document cites Smith (1987) as the source for half of the recommended values for the life of dioxin for adults (h), proportion of ingested dioxin that is stored in fat (f_1), and proportion of mother's milk that is fat (f_2).

U.S. EPA. 1994b. *Revised Draft Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Waste. Attachment C, Draft Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities*. Office of Emergency and Remedial Response. Office of Solid Waste. December 14.

This document recommends the use of the equation in Table C-3-1 and values for the variables in this equation: h (2,555 days), f_1 (0.9), and f_2 (0.3).